Sustainability and Urban Greenways

Indicators in Indianapolis

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Sustainability has emerged as a major theme in planning. Urban environmental planners frequently recommend greenways as one approach to making places greener, healthier, and more livable. This case study examines whether the greenways system in Indianapolis, Indiana, is sustainable using a framework based on six principles of sustainability recently proposed in the planning literature. Goals of the greenways master plan are linked to principles of sustainability, and indicators from an ad hoc set of empirical studies of the greenways are used to assess progress towards goals and sustainability. Planners can apply this framework elsewhere by linking goals developed in local planning processes to these principles, using available information to develop indicators, and, as part of continuing, iterative planning processes, designing data collection programs that yield more comprehensive sets of indicators over time.

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Sustainability has emerged as a primary theme in planning (Beatley & Manning, 1998; Berke & Conroy, 2000; Campbell, 1996). Participants in planning processes generally agree that sustainability is concerned with the environment, economics, and equity, but they often disagree on particular meanings of the concept. To clarify ambiguities in meaning and to link the abstract concept to planning practice, planners are developing systems for tracking indicators of sustainability (Maclaren, 1996). Within urban planning processes, planners often recommend greenways to make places greener, healthier, and more livable (Beatley & Manning, 1998; Fabos & Ahearn, 1996; Flink & Searns, 1993; Little, 1990; Mertes & Hall, 1995). Greenways are linear open spaces or parks along rivers, ridgelines, or historic infrastructure corridors such as canals or railroads that connect people with places and provide opportunities for recreation, conservation, and economic development. The general assumption seems to be that greenways intrinsically constitute sustainable development. This assumption warrants study.

I use a case study approach in this article to explore the sustainability of urban greenways. The primary question I address is whether the greenways system in Indianapolis, Indiana, is sustainable. A secondary objective is to illustrate how planners can use the results of ad hoc studies in a broad framework to identify gaps in information needed for more thorough assessments of sustainability. I begin with discussions of the meaning of sustainability and the evolving role of greenways in planning. Following a description of the greenways system in Indianapolis, I link its goals to principles of sustainability and introduce a set of indicators that can be used to gauge progress towards goals. I then assess the sustainability of the Indianapolis system, drawing on a series of studies that have been completed since 1996. These studies provide information about how people use trails and value a greenways system, economic benefits associated with recreational trail use, equity of access to trails, and ecological conditions of greenway corridors. I conclude with a discussion of the implications for greenway systems elsewhere and for planning practice. Limitations of the use of ad hoc studies to

assess implementation are noted, and ways to overcome these limitations are discussed.

Sustainability and Urban Greenways

For nearly two decades, planners have worked to define sustainable development and understand its implications for practice. The World Commission on the Environment and Development (WCED) helped establish sustainable development as a central focus within the planning profession. Defining it as development "that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 8), the WCED argued persuasively that sustainable development is a multifaceted process that encompasses dimensions of ecology and equity, as well as economics. Planners now recognize sustainable development as development that is profitable, green, and fair (Bartelmus, 1994; Campbell, 1996), and the use of sustainability as a normative guide for practice is common (e.g., Grant et al., 1996). Critics have observed, however, that the concept is quite general and idealistic (Campbell, 1996), that it may have more rhetorical value than significance for substantive policy (Andrews, 1997), and that adoption and implementation of sustainable principles and practices "is not immediately apparent" (Berke & Conroy, 2000, p. 22).

To make the concept more relevant for practice, planners are working to clarify its meaning and establish principles and indicators for assessing policies and measuring progress. Planners agree that sustainable development does not lead to some ideal or idyllic state, but instead is a dynamic, complex process concerned with balancing the sometimes conflicting objectives of economic development, environmental protection, and equitable distribution (Campbell, 1996; Innes & Booher, 1999; Kaiser et al., 1995; Shepherd & Ortolano, 1996). They also agree that indicators developed through collaborative processes can help guide efforts to make places more sustainable (Innes & Booher, 1999; Maclaren, 1996; Miller, 1999). Maclaren (1996) has described the use of sustainability indicators in explicit frameworks, and some places, such as Seattle (Miller, 1999), King County, Washington, (2000) and the City of Albuquerque (2000) are now using indicators to guide planning processes. Indicators used in particular places necessarily and appropriately will vary in response to local conditions, priorities, goals, and objectives.

Berke and Conroy (2000) recently illustrated the importance of linking theory and practice when they used six principles of sustainability to guide an evaluation of 30 comprehensive plans. Their definition of sustainable development builds on the WCED definition and integrates several lines of inquiry in the planning literature:

> . . . a dynamic process in which communities anticipate and accommodate the needs of current and future generations in ways that reproduce and balance local, social, economic, and ecological systems, and link local actions to global concerns. (p. 23)

Their six principles are:

- Harmony with nature
- Livable built environments
- Place-based economy
- Equity
- Polluters pay
- Responsible regionalism

They are concerned with the "location, shape, scale, and quality of human settlements" (p. 23). They found that "explicit inclusion of the concept has no effect on how well plans actually promote sustainability principles" (p. 30) and recommended that "planners examine the linkage between plans, implementation efforts, and the sustainability of outcomes" (p. 31).

Another contemporary trend in planning involves planning for greenways. Most of the literature on greenways has not used the language of sustainability, but proponents of greenways historically have been concerned with many of the same issues as advocates of sustainable development. Scholars trace the origins of the modern greenways movement to Frederick Law Olmsted and the City Beautiful movement that dominated planning at the turn of the 20th century (Little, 1990; Searns, 1996; Walmsley, 1996). Citing examples that include 16 of the best known greenways in America, Little (1990) concludes that the rationales for City Beautiful remain relevant today and that greenways are good for people, the economy, and the environment. Echoing these themes, other authors provide rationales and guidance for planning and developing greenways (Mertes & Hall, 1995; Ryan, 1993; Smith & Hellmund, 1993).

Just as scholars have begun to assess whether sustainability has made a difference in planning practice, researchers have begun to assess greenways to understand better the types of benefits they provide. The most comprehensive assessment to date appeared in 1995 in a special issue of the journal *Landscape and Urban Planning* (Vol. 33, Nos. 1–3), which has been republished as a book, *Greenways: The Beginning of an International Movement* (Fabos & Ahern, 1996). Most of the articles in this volume are historical, integrative, or normative, but a few

provide detailed analyses of particular greenways (e.g., Luyumes & Tamminga, McGuckin & Brown, and Shannon et al.). In this book, Gobster reports significant variations in patterns of trail use on recreational greenways in Illinois, and Burley explores patterns of vegetative growth and wildlife occupancy of habitat in the Red River Valley greenway. None of the articles explicitly uses a sustainability framework for evaluation.

More recently, however, the literatures on sustainability and greenways have been joined. Shafer, Lee, and Turner (2000) explicitly link greenways to sustainability and the principles established by the WCED, and they provide a normative rationale for greenways:

> ... facilities of any type, including trails, should be planned and designed for a balance among the economic, environmental, and social characteristics of an area so that its residents can lead healthy, productive, and enjoyable lives. (p. 165)

They do not, however, develop indicators for each of these dimensions. Instead, they analyze survey results to show that different types of users value greenways for different reasons, and they draw inferences about contributions to quality of life. They conclude that greenways contribute most to livability, which represents intersections of the environmental and community (i.e., social) dimensions of quality of life, and less to the economic dimension.

The potential benefits of greenways can be integrated with the sustainability framework used by Berke and Conroy (2000), although one of their six principles as stated is not directly relevant. Greenways potentially contribute to *harmony with nature* by providing ecological benefits such as habitat, carbon sequestration, and mitigation of stormwater runoff; to local or *place-based economies* by providing recreational opportunities, enhancing property values, and creating opportunities for economic development; and to greater *equity* by improving access to neighborhoods and community facilities. They potentially increase the *livability of built environments* by enhancing urban form, adding aesthetic value, and increasing options for pedestrian and nonmotorized traffic. By creating linkages among communities, they may be responsive to the notion of *regionalism*. Because greenways generally are seen as a public good, however, the principle of *polluters pay* is not applicable, although *users pay* may be relevant. This framework can be used to assess the sustainability of particular greenways by matching goals developed in local planning processes with these broad principles and developing indicators that measure progress towards goals.

The Indianapolis Greenways System

Indianapolis is a good choice for a case study of urban greenways because of the comprehensive scope of its master plan and its relative success in building facilities. The Greenways Division of Indianapolis Parks and Recreation has received national recognition, including a design award from the American Society of Landscape Architects. More recently, the flagship of the system, the Monon Rail-Trail, was designated a Millennium Trail by the White House Millennium Council and a Millennium State Legacy Trail by the American Trails Board (Indy Parks Greenways, 2000). These types of awards and other factors led Peter Harnik (2000), author of a comparative assessment of urban parks in America, to observe, "Indianapolis hopes to become the greenway capital of the nation" (p. 189). Figure 1 shows the main features of the system.

The origins of the greenways system in Indianapolis date from the early 20th century, when the Board of Park Commissioners retained two City Beautiful landscape architects, John Olmsted and George Kessler, to prepare master parks and boulevard plans (Indy Parks, 1994). The Kessler plan, completed in 1909, was never fully implemented, although some parks were built, and parkways were developed along some streams. Development of riparian and other corridors then languished until the early 1990s when the City, motivated by the need to conserve remaining green space, initiated a county-wide greenways planning process. The City adopted the greenways master plan in 1994 (Indy Parks, 1994), began trail development, and updated the plan in 1999.

The plan establishes five goals:

> 1. Provide opportunities for recreation, health, and fitness through trail activities;
>
> 2. Protect important wildlife habitat and promote the conservation of open space, forest and wetland areas;
>
> 3. Link Indianapolis neighborhoods with each other and with parks and other community assets;
>
> 4. Educate the public about the importance of the natural environment of the greenways system;
>
> 5. Become an economic asset to the community by promoting economic development and by making Indianapolis a desirable place where new business can locate. (Greenways Division, 1999, p. 1)

Figure 2 shows the land uses along the trails as of 1999.

The plan calls for the creation of 14 linked greenway corridors, 4 of which initially were developed as park-

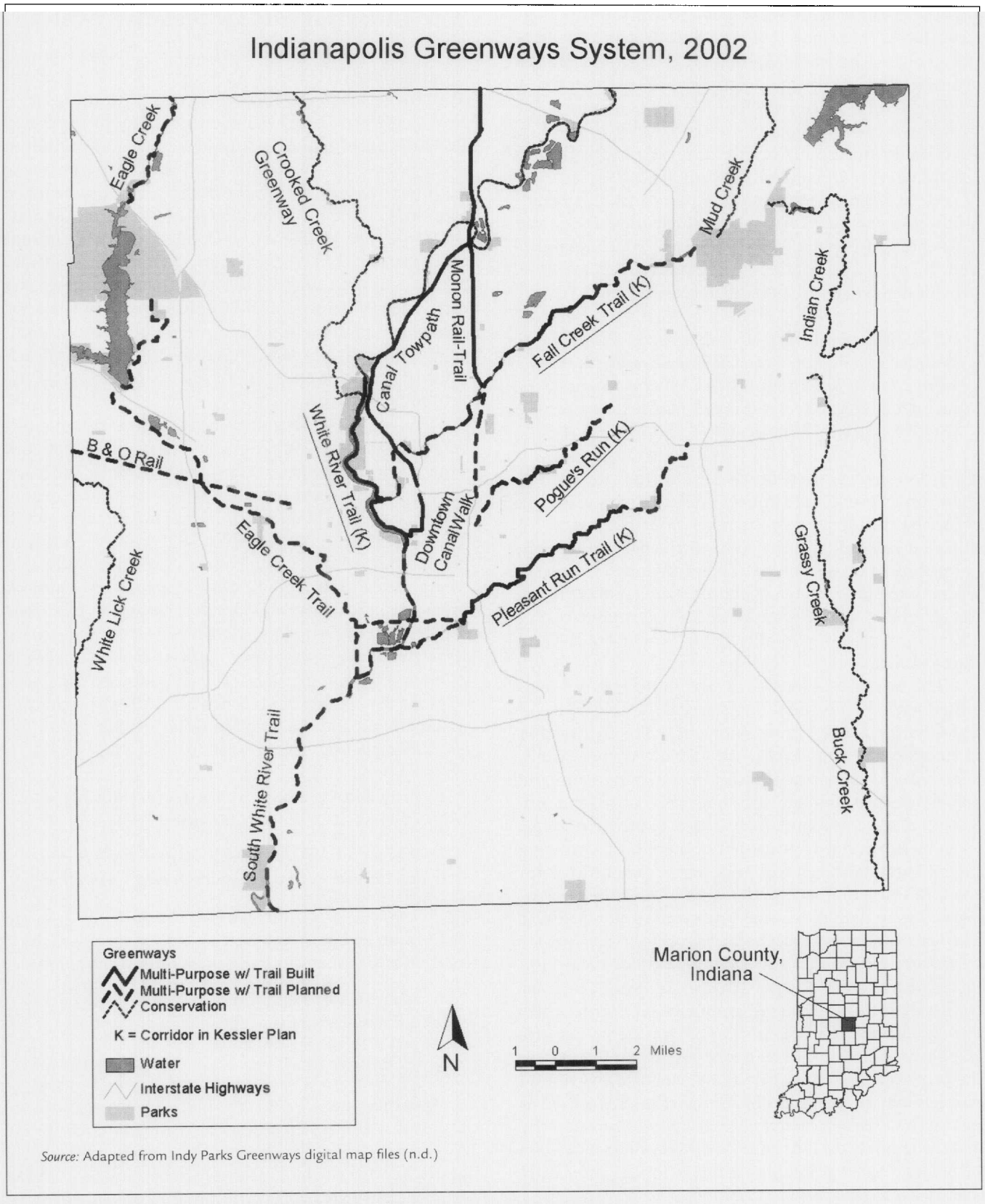


FIGURE 1. Indianapolis Greenways System in Marion County, Indiana.

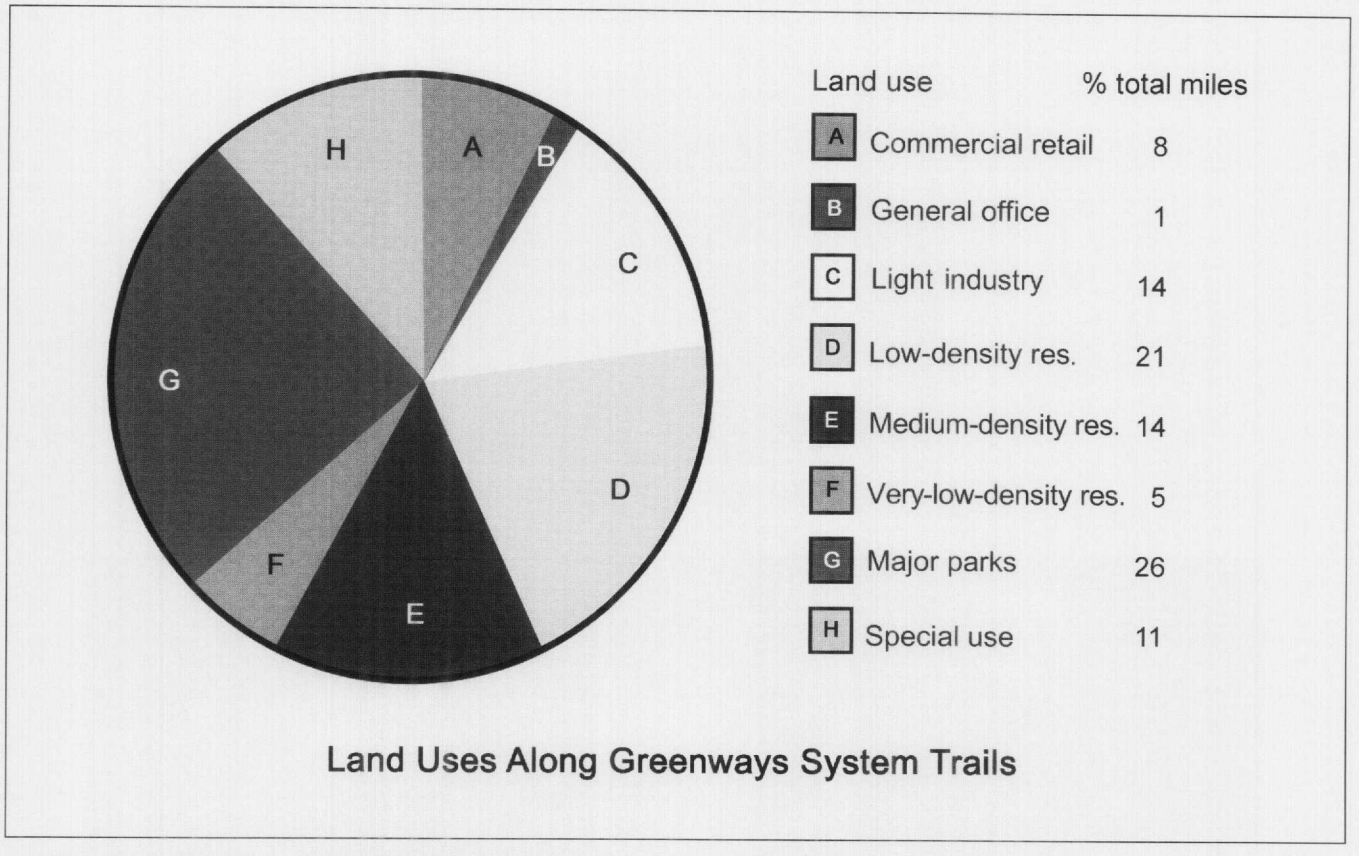


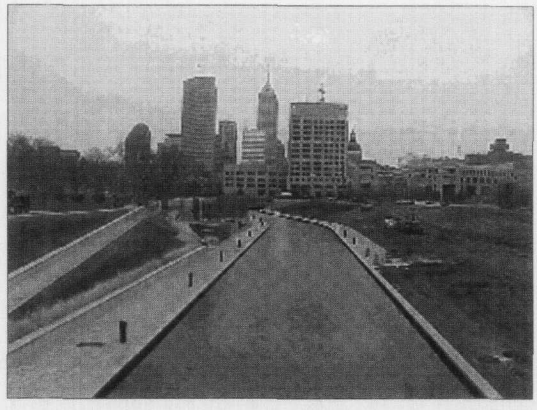
FIGURE 2. Land uses along Indianapolis Greenways System trails, 1999.

ways along streams, as recommended in Kessler's Parks and Boulevard Plan (see Figure 1). The greenway corridors, which are essentially place designations with no fixed boundaries, include 1 river, 10 streams, an historic 1836 canal towpath, and 2 historic rail lines. Seven of the corridors eventually will include publicly accessible trails. Several of these are shown in Figure 3. These trails will be located within broader public open spaces that, depending on contiguous uses, provide habitat or other ecological benefits. The other seven corridors, which are mostly in private ownership, will be conservation corridors and will not provide public access except at existing parks. Their purpose is to encourage better voluntary stewardship of green space by property owners. When completed, the system will include approximately 175 miles of trails and conservation corridors and 4,700 acres of open space and will link 57 parks and 125 destinations such as museums. One of the most important links in the system is to the White River State Park, an urban park on the west side of the central business district that anchors a museum-entertainment district tied together with a canal that is being developed as part of the Central Indianapolis Waterfront Project and connects to the White River Trail (see Figures 1 and 2).

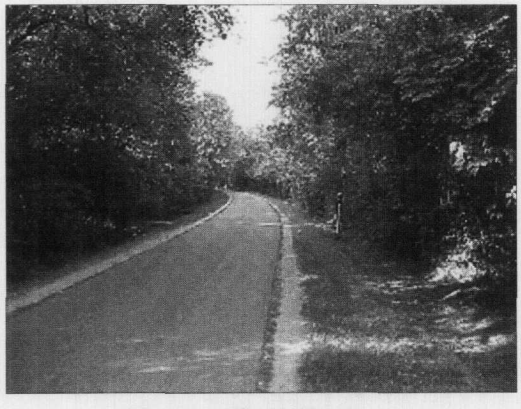
Development of the greenways began in 1995, with priority given to corridors that will include recreational trails. By 1998, approximately 30 miles of trails had been completed in six corridors. An additional 50 miles will be completed by 2004 (see Table 1). Within those corridors with recreational trails (see Figure 3), about two thirds of the total length will be bordered by residential uses, which generate users, or by parks, which are potential destinations for users (Graduate Planning Workshop, 1999).

A Framework for Assessing Sustainability

The Indianapolis Greenways Plan does not use the language of sustainability per se, but its goals can be linked to Berke and Conroy's (2000) principles of sustainable development to provide a framework for evaluating the sustainability of the greenways system. The plan's five goal statements correspond directly to four of

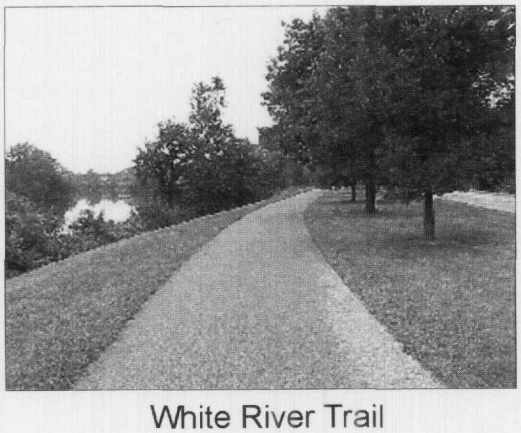


Central Indianapolis Waterfront Project

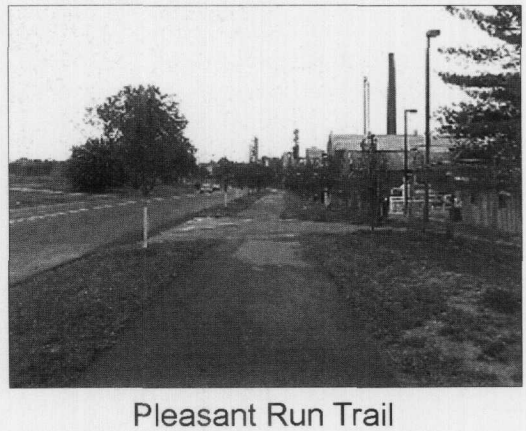


Monon Rail-Trail

Canal Towpath



White River Trail



Pleasant Run Trail

FIGURE 3. Land uses along trails in the Indianapolis Greenways System, 1999.

the six principles (see Table 2). (They do not address the principles of polluters pay or responsible regionalism, although, as will be shown, some local activities address these two principles.) Indy Parks Greenways Division has not formally established indicators for measuring progress towards its five goals, but the Division has participated in a number of studies that provide relevant information. I used these studies to develop indicators that link to the five goals and the four principles of sustainability (see Table 2). My primary objective was to assess the sustainability of the system.

TABLE 1. Characteristics of greenway multipurpose trails.

Dimension	Monon Rail-Trail	Canal Towpath	White River Trail	Pleasant Run Trail	Eagle Creek Trail	Fall Creek Trail	Pogue's Run Trail
Built length, 1999 (miles)	7.6	5.2	4.8	6.9	0	3.2	2.3
Planned length, 2004 (miles)	10.6	5.2	22.8	6.9	22.4	13.2	2.3
Trail width (feet)	10 to 15	5 to 8	8 to 12	5 to 12	10 to 12	7	6

Sources: Greenways Division (1999), Indy Parks (1994)

TABLE 2. A framework for evaluating the sustainability of urban greenways.

Definition of sustainable development: *Sustainable development is a dynamic process in which communities anticipate and accommodate the needs of current and future generations in ways that reproduce and balance local, social, economic, and ecological systems, and link local actions to global concerns.* (Berke & Conroy, 2000, p. 23)

Principles[a]	Plan goal statements[b]	Indicators
Place-based economy	Become an economic asset to the community by promoting economic development and by making Indianapolis a desirable place where new business can locate	Economic: User counts Net benefits Willingness to donate
Equity	Link Indianapolis neighborhoods with each other and with parks and other community assets	Equity: Equity of access
Harmony with nature	Protect important wildlife habitat and promote the conservation of open space, forest, and wetland areas Educate the public about the importance of the natural environment of the greenways system	Ecological: Species frequency & dominance Habitat quality Aquatic biodiversity Canopy cover
Livable built environments	Provide opportunities for recreation, health, and fitness through trail activities	Economic and social: User counts City-county population surveys Greenway population surveys User surveys
Polluters pay (users pay)	None	Economic: Willingness to donate
Responsible regionalism	None	None

Sources:
a. Berke & Conroy (2000)
b. Greenways Division (1999, p. 1), Indy Parks (1994)

Promoting Economic Development: Economic Indicators

The goal of promoting economic development addresses the economic dimension of sustainability and the principle of a place-based economy (see Table 2). Greenways potentially produce both direct economic benefits by enhancing recreation and increasing property values and indirect benefits by stimulating local business. These benefits cannot be measured easily, because greenways are public goods, and people do not pay fees to use them, but economists have developed methods for imputing the value of recreational benefits based on estimates of levels of use. Although the Greenways Division has commissioned no economic analyses, estimates are available for some trails, as are economic analyses sponsored by other organizations. Economic indicators used in this study include user counts (Baukert et al., 1996; Graduate Planning Workshop, 1998; Lindsey, 1999), estimates of net benefits from benefit-cost analyses of three projects (Fienning, 1998; Nguyen, 2001; Przybylski, 2000; 1998; Przybylski & Lindsey, 1996), and a study of people's willingness to donate for stewardship of a conservation corridor (Lindsey & Knaap, 1999; Lindsey et al., 1998).

Linking Neighborhoods, Parks, and Community Assets: Indicators of Equity

The goal of linking neighborhoods with parks and community assets addresses issues of accessibility and therefore is concerned with equity and the social dimension of sustainability (see Table 2). The literature on equity in distribution of public services is extensive, and policymakers historically have been concerned that people have equal access to recreational facilities such as parks. Both equity and accessibility have multiple definitions and can be measured in different ways (Talen, 1998). For example, one definition of equity is *sameness*—in this context, equal access to greenways for people of all races and classes. A second definition of equity is related to *fairness* and involves the notion that the disadvantaged should have disproportionate access because they have greater needs. Access can be measured by proximity, distance, or travel time. Greenway planners in Indianapolis have not explicitly addressed the issue of equity of access to the greenways in planning processes, but recent analyses of the sociodemographic characteristics of populations in greenway corridors can be used to develop indicators of equity of access (Lindsey et al., 2001).

Protecting Habitat and Educating People about the Environment: Ecological Indicators

The goals of protecting habitat and conserving open space, forests, and wetlands and of educating the public about the environment address the ecological dimension of sustainability and relate to the principle of harmony with nature (see Table 2). From a lay perspective, greenways are natural or green by definition. From an ecological perspective, however, some greenways are "greener" than others. That is, some greenways comprise open space with extensive hardscaping and intensive maintenance of ornamental vegetation, while others are more natural and provide habitat benefits. Some greenways that appear natural to the lay person may be little more than "deserts" of invasive exotic species that reduce vegetative diversity and provide little habitat for native fauna. Environmental planners increasingly use habitat and diversity indices as indicators or benchmarks in planning processes. The Greenways Division has no comprehensive analyses of the ecological condition of the system, but ecological studies of particular corridors have been completed. Terrestrial indicators used here include frequency and dominance of riparian tree species (Brothers & Hearne, 1997) and forest canopy cover (Barr et al., 1999). Aquatic indicators include the Qualitative Habitat Evaluation Index (QHEI), a numerical indicator based on interpretation of stream and riparian characteristics such as morphology, flow, vegetation, and contiguous land use, and the Index of Biotic Integrity (IBI), which measures biodiversity (White, 1994).

Providing Opportunities for Recreation, Health, and Fitness: Social and Economic Indicators

The goal of providing opportunities for recreation, health, and fitness addresses primarily the social dimension of sustainability and relates to the principle of a livable built environment (see Table 2). This goal also indirectly addresses the economic dimension of sustainability. Counts of users, as noted above, provide information about whether residents are taking advantage of opportunities for recreation and fitness. Sample surveys of the population and of specific groups such as trail users and trail neighbors can provide information on how greenways contribute to livability and quality of life, as well as issues in greenway management. For example, surveys of the general population can provide information about the importance of greenways relative to other public priorities, while surveys of users can provide benchmarks for evaluating the effectiveness of changes in management strategies. Surveys of trail neighbors can provide information about perceived effects on property values and problems such as littering or trespassing. Indy Parks and the Greenways Division has sponsored a series of surveys both as part of its master planning process and to address particular issues

(Baukert et al., 1996; Graduate Planning Workshop, 1998; Lindsey & Knaap, 1999; Lindsey et al., 1998; Polis Center, 1998). Selected results are used here to illustrate how people's opinions of the use, importance, effects, and maintenance of greenways can be used as economic and social indicators.

Polluters Pay and Responsible Regionalism

As shown in Table 2, the Greenways Plan does not include goals that link directly to the principles of polluters pay and responsible regionalism. However, a principle related to the polluters pay principle is *users pay*, and information from a survey of people's willingness to donate for stewardship of a conservation corridor serves as an economic indicator. The Greenways Division cooperates with efforts by planners in adjacent counties to plan connections among corridors, but no specific indicators related to this principle are presented here.

Indicators of Sustainability in Indianapolis

Indicators developed from studies related to the greenways can be used to draw inferences about progress towards goals and the sustainability of the greenways system:

- No economic evidence exists for a majority of the corridors. Economic indicators are available for two trails (Monon Rail-Trail and White River), the Central Indianapolis Waterfront Project, and the Crooked Creek Conservation Corridor. Counts of users on the Canal Towpath and the Pleasant Run Trail also are available. These indicators suggest that some segments of the system are economically efficient, but that others may not be.
- Indicators of equity of access are available for all corridors with planned trails (see Figure 1 and Table 1). These linkages among diverse neighborhoods have been established, and lower income, minority neighborhoods have access to greenway trails, but populations are segregated along some trails.
- Ecological indicators are available for six of the corridors (Pleasant and Pogue's Runs and Crooked, Indian, Lick, and Mud Creek Greenways). They indicate that from an ecological perspective, the greenways are not green.
- Social and economic indicators are available for all corridors with built trails. They show that residents are taking advantage of new opportunities for recreation, health, and fitness and that majorities of the general public, trail neighbors, and trail users view the greenways positively.

A limitation of the study is that data for building indicators for all corridors and the system as a whole simply are not available.

Economic Indicators

Economic indicators, including user counts, estimates of net economic benefits, and estimates of willingness to donate, are summarized in Table 3. Analyses of randomized counts of users in 1996 and 1998 on four of six existing trails indicate that the annual number of visits to the system is nearly 1.3 million (Baukert et al., 1996; Graduate Planning Workshop, 1998; Lindsey, 1999). Use varies greatly across trails, by day of week, and by time of day. Recent measurements of trail traffic with infrared counters on the Monon Rail-Trail show that average weekend use exceeds average weekday use, but that peak hour use occurs in early evenings on weekdays (Hurt et al., 2001). Peak levels of use are sufficient to cause congestion: Peak hourly levels of use recorded in three of four months in 2000 exceeded 500, or a user every 5 to 7 seconds. High levels of use imply economic benefits, but formal analyses have been completed only for two trails and one project that links to one trail.

In 1998, a graduate student using 1996 counts and the travel cost method estimated net economic benefits of the most heavily used trail, the Monon Rail-Trail (Fienning, 1998). Her estimates of total net present benefits ranged from $10.1 million to $15.7 million. In 2001, a student estimated benefits of the trail with the least use, the White River Trail, using a similar approach (Nguyen, 2001). His analyses show that this trail has negative net benefits and a benefit-cost ratio in the range of only 0.36 to 0.42. Analyses commissioned by the U.S. Army Corps of Engineers (USACE) in 1996, 1998, and 2000 indicate, however, that the Central Indianapolis Waterfront Project, an open space and trail project linked to the current terminus of the White River Trail, has positive net benefits and a benefit-cost ratio greater than 1.5 (see Table 3; Przybylski, 1998, 2000; Przybylski & Lindsey, 1996). Sensitivity analyses completed in the 2000 USACE study indicate that if projected use were reduced 37%, annual net benefits would still be positive.

Other economic indicators are available from a contingent valuation survey of residents of one of the seven conservation corridors. This survey explored differences between people's hypothetical and actual willingness to donate to the White River Greenways Foundation for educational programs, cleanup activities, and other projects to improve the quality of the Crooked Creek Green-

TABLE 3. Economic indicators for Indianapolis Greenways System.

User counts, trail traffic, and congestion[a]

Trail	Estimated annual user visits	Monthly traffic	Average daily traffic (% @ peak hour) Weekday	Weekend	Highest peak hour traffic
Monon Rail-Trail	819,000	Not measured	Not measured	Not measured	Not measured
September 2000	Not estimated	55,148	1,618 (17.9)	2,352 (10)	554
October 2000	Not estimated	45,606	1,133 (19.4)	2,181 (12.6)	635
February 2001	Not estimated	21,852	668 (18.7)	1,088 (12.2)	291
March 2001	Not estimated	41,986	997 (17.7)	2,227 (13.1)	501
Pleasant Run Trail	166,000	Not measured	Not measured	Not measured	Not measured
White River Trail	79,000	Not measured	Not measured	Not measured	Not measured
Canal Towpath	227,000	Not measured	Not measured	Not measured	Not measured
TOTAL SYSTEM (4 of 6 active trails)	1,293,000	Not measured	Not measured	Not measured	Not measured

Economic benefits[b]

Location	Total net present value	Benefit-cost ratio	Projected annual users
Monon Rail-Trail (1998)	$10.1 to $15.7 million	8.7 to 12.8	937,000
White River Trail	−$512,500 to −$462,300	0.37 to 0.42	52,000
Central Indianapolis Waterfront Project	Annual net benefits		
1996	$4,000,000	1.4	1,900,000
1998	$5,900,000	1.6	2,450,000
2000	$6,500,000	1.59	2,480,000

Willingness to donate[c]

Crooked Creek Conservation Corridor	Percent stated willing: Survey	Request	Mean stated amount	Mean actual donation
Greenway residents	51%	36%	$10.76	$0.80
City-county population	22%	11%	$ 1.51	$0.10

Sources:
a. Baukert et al. (1996), Graduate Planning Workshop (1998), Hurt et al. (2001), Lindsey (1999)
b. Fienning (1998), Nguyen (2001), Przybylski (1998, 2000), Przybylski & Lindsey (1996)
c. Lindsey & Knaap (1999), Lindsey et al. (1998)

way (see Table 3; Lindsey & Knaap, 1999; Lindsey et al., 1998). While a majority of corridor property owners said that they would donate in response to a hypothetical question, only slightly more than one third said so in response to an actual request for donations. Moreover, their hypothetical willingness to donate exceeded actual willingness to donate by a factor of 13. Significantly smaller proportions of county residents said they were willing to donate, and their mean donations also were significantly smaller. These results suggest that economic support for conservation corridors is limited.

Indicators of Equity

Indicators of equity of access that relate to the goal of linking neighborhoods are available for the seven recreational greenways but none of the conservation corridors (see Table 4). These analyses show that minorities and the poor have disproportionate access to greenways

(as measured by proximity), but trail populations are segregated among and along trails (Lindsey et al., 2001). The trail population—the people residing in census tracts within 0.5 mile of existing and planned trails—is 35% African American, while Marion County is only 21% African American. The proportion of African American residents in five of the recreational corridors is at least 50% higher than in the county overall and more than twice as high in two corridors. Across greenway corridors, median household income is 90% that of the county. The trail population also has slightly lower educational achievement and higher rates of poverty. Neighborhoods bisected by four of the trails change from nearly all or a majority of Whites to nearly all or a majority of African Americans.

With respect to equity of access, these indicators can be interpreted in different ways. If the equity criterion is sameness, and if one assumes that the distribution of greenways services is equitable if the population characteristics of the trail neighbors are the same as those of the city/county population, then equity of access does not exist. Alternatively, if the equity criterion is need, and the outcome is considered equitable if the disadvantaged have greater access, then the current outcome of system development can be considered equitable.

Ecological Indicators

Ecological indicators include canopy cover, species frequency and dominance, habitat duality, and diversity. These indicators are available for the quality of the riparian forest in only one conservation corridor and for aquatic habitat and diversity in streams in six corridors (see Table 5). The landscape is naturally green in Indianapolis: 98% of the presettlement vegetation was forest, mainly beech/maple and oak/hickory communities, with the remainder being floodplain forest, wetlands, or open water (Barr et al., 1999). Recent analyses of the county show, however, that only 13% of the county has medium to dense forest canopy, and this canopy is mostly in residential neighborhoods (Barr et al., 1999). Brothers and Hearne (1997) sampled riparian vegetation in 16 locations along the Crooked Creek Greenway corridor and measured watershed tree cover (11%). Their investigation indicated that none of the riparian forest was natural and that, as measured by diameter at breast height (DBH) and total number of stems, the forest was dominated by species not characteristic of mature, riparian forest such as box elder, ash, and Russian white mulberry. They also concluded that exotic species were threatening the integrity of the poor-quality forest that remained.

White (1994) assessed the ecological integrity of streams in four conservation and two recreational corridors (see Table 5). Using the Qualitative Habitat Evaluation Index (QHEI), she found that the quality of aquatic habitat was good in only one stream, fair in two, and poor in three. The diversity of the fish community, as measured by the Index of Biotic Integrity (IBI), ranged from poor to good as well, with only one stream considered to have good diversity.

Social Indicators of Livability

Sample surveys of county residents, trail neighbors and corridor residents, and trail users provide indicators that address the goal of providing opportunities for recreation, health, and fitness and the principle of a liv-

TABLE 4. Indicators of equity of access.

Location	1990 median household income ($)	Ratio to county median household income	African American population (%)	Ratio to county African American population
Canal Towpath	34,909	1.2	37	1.8
Eagle Creek Trail	29,355	1.0	6	0.3
Fall Creek Trail	30,732	1.1	43	2.0
Monon Rail-Trail	27,399	0.9	43	2.0
Pleasant Run Trail	22,559	0.8	7	0.3
Pogue's Run Trail	18,641	0.6	34	1.6
White River Trail	24,091	0.8	38	1.8
TOTALS	26,044	0.9	35	1.7
Marion County	29,039	1.0	21	1.0

Note: Trail segments planned for completion by 2004; no analyses of conservation corridors.

Source: Lindsey et al. (2001)

TABLE 5. Ecological indicators: Aquatic habitat and species diversity.

Location	Qualitative Habitat Evaluation Index (<50 = poor)	Index of Biotic Integrity (<25 = poor)
Pleasant Run Trail	46	21
Pogue's Run Trail	46	31
Crooked Creek Greenway	71	34
Indian Creek Greenway	41	21
Lick Creek Greenway	50	27
Mud Creek Greenway	53	43

Source: White (1994)

Note: Indicators not relevant for Canal Towpath and Monon Rail-Trail. No measurements taken for Eagle Creek, Fall Creek, and White River Trails nor for Buck Creek, Grassy Creek, and Indian Creek Greenways.

able built environment (see Tables 6 and 7). As seen above, residents clearly are taking advantage of the new opportunities provided by the greenways. As Table 6 shows, approximately 31% of respondents (n = 1226) in a telephone survey of households conducted as part of the Indy Parks master planning process reported using greenways or trails in parks (Polis Center, 1998). In a mail survey of the county population, the percentage of respondents who said that they used different greenway trails at least once a month ranged from 5 to 12% (Lindsey et al., 1998). More than 80% of trail neighbors said that they use the Pleasant Run Trail (Graduate Planning Workshop, 1998), while large proportions of users on trails reported visiting them three or more times per week (see Table 6).

Table 7 shows that a majority of county residents believe that greenways are important, and both trail neighbors and users believe that trails are well maintained. Approximately 83% of county residents said that it was very important (52%) or somewhat important (31%) that "Indy Parks develop greenway trails" (Polis Center, 1998, p. 27). In the study of the Crooked Creek Greenway conservation corridor, approximately 56% of county residents said that they thought it very likely or somewhat likely that greenway designation would improve the quality of the neighborhood, and 36% said that designation would increase property values; only 5% thought it might adversely affect values (Lindsey et al., 1998). Corridor property owners expressed similar opinions.

In the sole study that has comparable measures for trail neighbors and users, users consistently rated maintenance higher than neighbors, but both groups generally indicated that the trails were well maintained. Ratings of the quality of maintenance on the Monon Rail-Trail and the Canal Towpath were obtained on different scales, but generally are comparable. For example, more than 90% of users believe that trash removal and brush and grass cutting are excellent or satisfactory, and more than 80% state that removal of graffiti is excellent or satisfactory (Baukert et al., 1996; Lindsey, 1999). The major problems involved conflicts with other users, including the failure of people to clean up after their dogs and the failure of users to communicate before passing.

Discussion and Implications for Planning

Sustainability has become a central focus of planning, and planners need to explore the sustainability of the outcomes of local planning initiatives. This case study has explored the question of whether the greenways system in Indianapolis is sustainable by establishing a framework that links indicators with the goals of the greenways plan and six principles of sustainability recently proposed in the planning literature. A multidimensional conception of sustainability such as the one used here implies tradeoffs among dimensions. In this case, available indicators suggest uneven progress towards goals and sustainability. People clearly think the greenways add to the livability of their communities. Lower income and minority households have access to the trails, and some of the trail projects have positive economic benefits, although one may not. Data for constructing ecological indicators have not been collected as systematically, but available indicators suggest that both the terrestrial and aquatic ecosystems of the greenways are degraded relative to natural systems. This uneven progress reflects the priorities of the Greenways Division, which has emphasized development of recreational corridors over conservation corridors, in part to

TABLE 6. Economic and social indicators: Households that use trails.

Location	General county population (%)		Trail neighbors/ Corridor residents (%)		Trail users (%) (≥3x/week)
	Survey 1[a]	Survey 2[b]	Survey 3[c]	Survey 4[d]	Surveys 5 & 6[e]
Greenways system	31				
Canal Towpath	4	6		7	48
Eagle Creek Trail	5.5	12		15	
Fall Creek Trail	2	5		3	
Monon Rail-Trail	13	7		10	27
Pleasant Run Trail	2	5	83 (37% ≥3x/wk)	1	53
Pogue's Run Trail	Not measured	0		<1	
White River Trail	Not measured	7		9	

Sources:
a. Polis Center (1998)
Note: Persons in household may also use other trails.
b. Lindsey et al. (1998)
c. Graduate Planning Workshop (1998)
d. Lindsey et al. (1998)
e. Baukert et al. (1996), Graduate Planning Workshop (1998)

TABLE 7. Additional social indicators: Effects of greenways on liveability.

Location	Selected indicators of importance (%)			Selected indicators of maintenance quality (%)				
	Importance of greenway trails	Improve neighborhood quality	Increase property values	Trash removal	Maintenance of grass	Trail surface condition	Availability of parking	Scooping after dogs
General population								
Marion County	83[a]	56[b,h]	36[g,h]					
Trail neighbors/Corridor residents								
Crooked Creek Trail		54[b]	36[g]					
Pleasant Run Trail	Not measured	78[c]	58[c]	64[d]	81[d]	90[d]	57[d]	48[d]
Trail users								
Canal Towpath	Not measured	Not measured	Not measured	92[e]	93[e]	89[e]	66[e]	81[e]
Monon Rail-Trail	Not measured	Not measured	Not measured	92[e]	84[e]	95[e]	73[e]	67[e]
Pleasant Run Trail	Not measured	Not measured	Not measured	78[f]	93[f]	95[f]	80[f]	74[f]

Sources: Baukert et al. (1996), Graduate Planning Workshop (1998), Lindsey et al. (1998), Polis Center (1998)

Note: Response options varied among surveys.

a. very important or somewhat important
b. very likely or somewhat likely
c. strongly agree or agree
d. agree on three-point scale
e. excellent or satisfactory on three-point scale
f. highly satisfactory or satisfactory on five-point scale
g. other options: decrease, have no effect, or no opinion
h. Crooked Creek Greenway only

build support among users for expansion of the system. Both the relative availability of information and the indicators themselves reflect this tradeoff. To the extent that degraded ecological conditions detract from the sustainability of the greenways, work to restore habitat and increase biodiversity in the corridors may be warranted.

This assessment necessarily has been ad hoc, relying on existing studies and linking available indicators from them to local goals and broader principles of sustainability. It is, therefore, not surprising that important indicators are not available for particular corridors or for the system overall. The potential limitation of this approach is that gaps in data may be so significant that definitive conclusions cannot be drawn: More comprehensive assessments might have yielded results that indicate either more or less progress towards sustainability. But from a longer-term perspective—one that is essential in thinking about sustainability—an incremental, ad hoc assessment is a necessary first step towards building more comprehensive sets of indicators that permit more definitive conclusions. When interpreted as part of a continuing, iterative planning process, ad hoc assessments like this one enable reassessment of priorities for data collection and analysis. For example, this assessment shows clearly that more is known about the recreational use of the greenways than about their ecological condition. Planners can use these findings to illustrate the need for more comprehensive sets of indicators and to demonstrate to system managers and stakeholders how additional information about poorly understood aspects of the greenways would provide insight into the overall sustainability of the system. More generally, planners can use this framework and these types of ad hoc assessments to establish a rationale for more systematic monitoring and feedback, including sets of programmed evaluative studies. Over time, more detailed systems of indicators like those described by Maclaren (1996) can be implemented.

Another limitation is that while many of the indicators in this particular case were developed from studies completed by faculty and students from a local university, planners in other communities may not have access to the same types of information. Planners can replicate this approach elsewhere, however, with appropriate adjustments to reflect different goals and the availability of different types of information. More generally, systematic, sustained outreach to local institutions and other agencies that share substantive responsibilities or interests may yield information relevant to assessing planning outcomes.

This study also demonstrates that the historic tension in planning between comprehensive and incremental approaches is relevant to the problem of assessing sustainability. Although the framework for assessment potentially is comprehensive, indicators are available only for a subset of relevant goals and principles and in most cases only for segments of the system. Most of the indicators themselves are only partial constructs of the ideal or desirable measure. For example, because no indicators of the economic benefits of the overall system are available, inferences have been drawn from corridor- and project-specific studies. Even these studies are only partial accounts of the total value of particular trails: They rely primarily on use values associated with recreation and do not incorporate the economic value of ecological services such as carbon sequestration or mitigation of runoff. For plans as ambitious as the Indianapolis greenways plan, comprehensive assessments of the sustainability of outcomes likely will be frustrated by both the complexity of the task and the resource requirements implicit in such tasks. Despite their limitations, ad hoc assessments illustrate how planners can link outcomes to place- and process-specific goals in a way that informs conversations about sustainability.

Finally, consistent with a process-oriented conception of sustainability, insights into the sustainability of the greenways system necessarily will change over time. For example, economic indicators will change as levels of use change in response to expansion of the trail system, population gains and losses, and changes in preferences for recreation. Equity of access will change as complex processes of suburbanization and gentrification unfold. Habitat, diversity, and other ecological indicators for the greenway corridors will change in response to greenway management, household landscaping decisions, and ongoing urban forestry and water management programs. Tracking indicators in this type of framework over time is one useful way to inform management decisions that affect the trajectory of change.

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